SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI I : 2024/2025

DJJ30093: ENGINEERING MECHANICS

TARIKH : 07 DISEMBER 2024
MASA : 11.30 PAGI – 01.30 PETANG (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) List **FOUR (4)** basic quantities terms in the field of mechanics.
*Senaraikan **EMPAT (4)** istilah kuantiti asas dalam bidang mekanik*

[4 marks]
[4 *markah*]

CLO1 (b) Calculate the magnitude and direction of resultant vector below.
Kirakan nilai magnitud dan arah bagi vektor paduan di bawah.

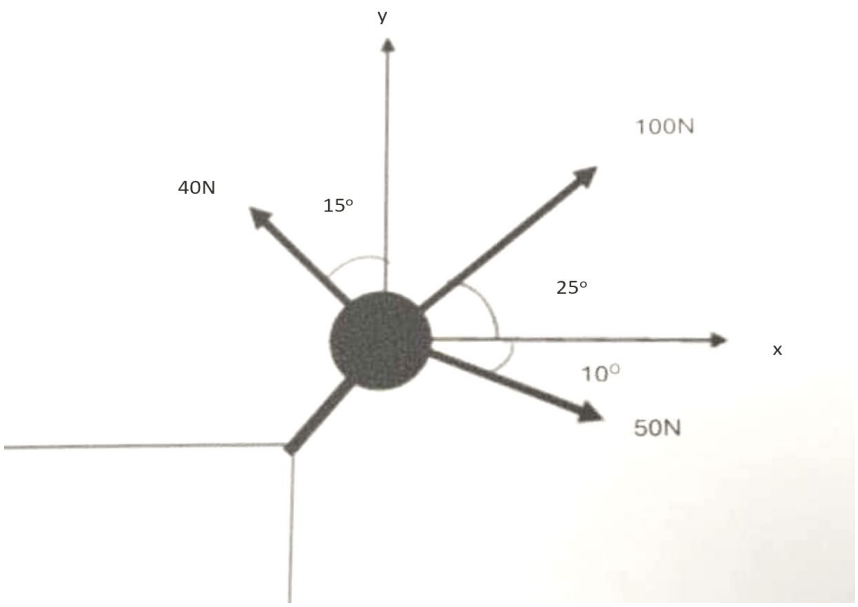


Figure 1 (b) / *Rajah 1 (b)*

[8 marks]
[*8 markah*]

CLO1

(c)(i) Explain the condition for the equilibrium of particle according to Newton's First Law.

Terangkan keadaan keseimbangan bagi sesebuah zarah berdasarkan kepada Hukum Pertama Newton.

[3 marks]

[*3 markah*]

CLO1

(c)(ii) Express the value of forces in each cord needed to hold the system in the equilibrium position.

Kirakan daya di setiap wayar yang diperlukan untuk memegang sistem supaya dalam keadaan keseimbangan.

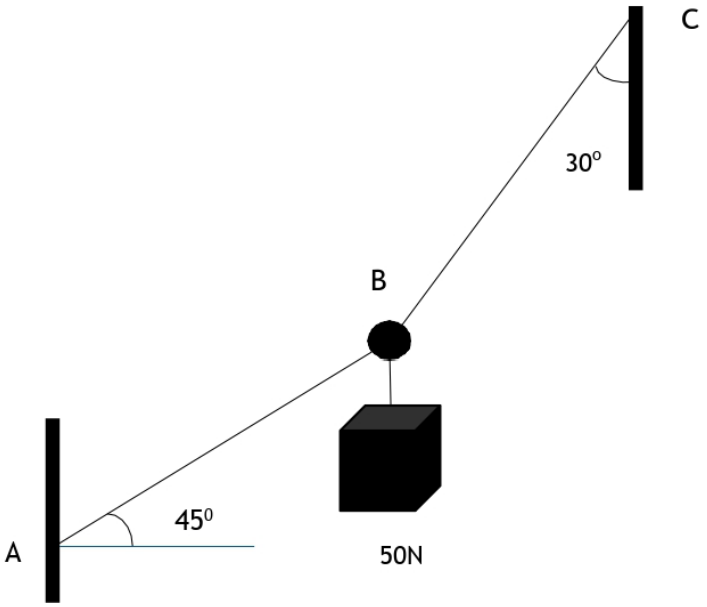


Figure 1(c)/ *Rajah 1(c)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO2 (a)(i) The truss used to support a balcony is subjected to the loading shown in Figure 2(a). Assume each joint as a pin. Draw the truss in the form of Free Body Diagram at joint C.

Kekuda yang digunakan untuk menyokong balkoni telah ditunjukkan daya-daya seperti dalam Rajah 2 (a) di bawah. Anggapkan setiap sendi adalah pin. Lakarkan kekuda dalam bentuk gambarajah badan bebas di sendi C.

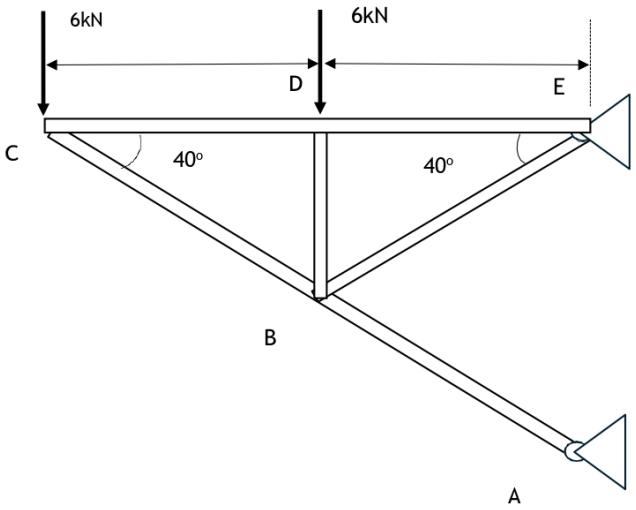


Figure 2 (a) / *Rajah 2(a)*

[2 marks]

[*2 markah*]

CLO2 (a)(ii) By using the method of joints, referring to the free body diagram at 2. (a)(i), calculate the force in member CB. State whether the members are in tension or compression.

Dengan menggunakan kaedah sendi, rujuk gambarajah badan bebas pada 2(a)(i), kirakan daya pada anggota CB. Nyatakan samada anggota tersebut dalam keadaan tegangan atau mampatan.

[3 marks]

[*3 markah*]

CLO2

(a)(iii) Given $F_{DC} = 7.15kN\ (tension)$. Draw the free body diagram at joint D. By using the method of joints, calculate the force in DB and DE. State whether the members are in tension or compression.

Diberikan $F_{DC} = 7.15kN\ (tegangan)$. Lukiskan gambarajah badan bebas pada sendi D. Dengan mengunakan kaedah sendi, kirakan daya pada DB dan DE. Nyatakan samada anggota tersebut dalam keadaan tegangan atau mampatan.

[6 marks]

[*6 markah*]

CLO2

(b)(i) The Pratt truss is shown in Figure 2(b) below. Illustrate the free body diagram for the truss.

Kekuda Pratt ditunjukkan dalam Rajah 2(b) di bawah. Lakarkan gambarajah badan bebas bagi kekuda tersebut.

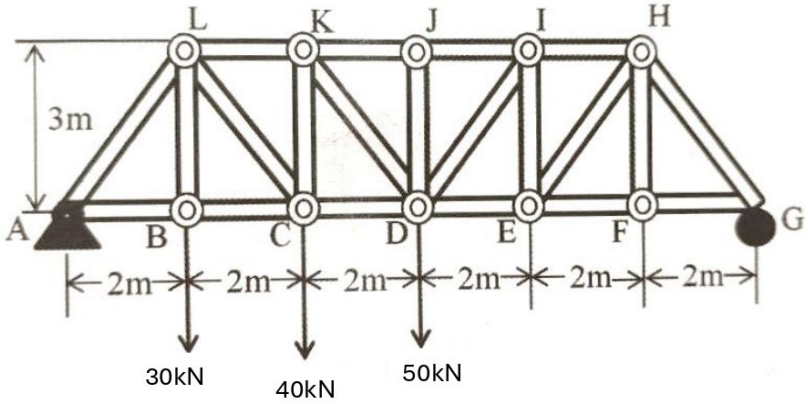


Figure 2(b) / *Rajah 2(b)*

[1 mark]

[*1 markah*]

CLO2

(b)(ii) By using your answer from 2(b) (i), determine the reaction force (A_x, A_y and G_y) at support A and G.

Dengan berpandukan jawapan anda pada 2(b)(i), tentukan daya tindak balas (A_x, A_y and G_y) pada penyokong A dan G.

[5 marks]

[*5 markah*]

CLO2 (b)(iii) By using the method of section, determine the force in members KJ, KD and CD of the Pratt truss shown in Figure 2 (b). Analyze if the members are in tension or compression.

Dengan menggunakan Kaedah Bahagian, tentukan daya pada anggota KJ, KD dan CD pada Kekuda Pratt yang ditunjukkan pada Rajah 2(b). Analisiskan samada anggota-anggota tersebut berada dalam keadaan tegangan atau mampatan.

[8 marks]
[*8 markah*]

QUESTION 3
SOALAN 3

CLO1 (a) State the definitions of the following terms:
Nyatakan definisi istilah yang berikut:

(i) Distance
Jarak

[2 marks]
[*2 markah*]

(ii) Displacement
Anjakan

[2 marks]
[*2 markah*]

CLO1 (b) A grinding wheel which initially at rest is rotated for 8s with constant angular acceleration of 3.5 rad/s^2. Then, the wheel is brought to rest with a uniform angular deceleration in 9 revolutions. Express the value of the angular deceleration needed and how long it takes to stop the wheel.

Satu roda pencanai yang bermula dari keadaan rehat berputar selama 8s dengan pecutan sudut seragam 3.5 rad/s^2. Kemudian roda tersebut dibiarkan untuk berhenti dengan awapecutan sudut seragam dalam 9 putaran lengkap. Kirakan nyahpecutan sudut yang diperlukan dan masa yang diambil untuk roda pencanai itu berhenti.

[8 marks]

[*8 markah*]

CLO1 (c) A car travels in a straight line with initial velocity 10 m/s. Then it accelerates uniformly at 2 m/s^2 for 100 m. Then it travels at a constant speed for 20s. Then it slows down at a constant deceleration of 1.49 m/s^2, until it stops.

Sebuah kereta bergerak dengan laju awal 10 m/s. Kemudiannya ia memecut dengan pecutan seragam 2 m/s^2 sejauh 100 m. Setelah itu, ia terus bergerak dengan kelajuan malar selama 20s. Sebelum mengakhiri perjalanannya, ia memperlahankan kereta dengan pecutan seragam 1.49 m/s^2 sehingga berhenti.

(i) Draw a velocity vs time graph for the whole journey

Lukiskan graf laju vs masa bagi keseluruhan perjalanan

[4 marks]

[*4 markah*]

(ii) Calculate the constant speed of the car

Kirakan laju malar kereta

[1 mark]

[*1 markah*]

(iii) Calculate the total travel distance of the car

Kirakan jumlah jarak yang dilalui oleh kereta

[8 marks]

[*8 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Give the definition of work (done by force) and state the condition where work is zero.

Berikan definisi kerja yang dilakukan oleh daya dan nyatakan situasi di mana kerja yang dilakukan oleh daya adalah sifar.

[4 marks]

[*4 markah*]

CLO1 (b) The 100kg crate is subjected to two forces as shown in Figure 4(b). If it is originally at rest, express the value of the distance it slides to attain a speed of 6 m/s. The coefficient of kinetic friction is 0.2.

Sebuah peti yang berjisim 100kg dikenakan dua daya seperti Rajah 4(b). Jika asalnya peti ini berada di dalam keadaan pegun, nyatakan jarak yang perlu dilalui oleh peti ini untuk ia mencapai kelajuan 6 m/s. Diberi pekali geseran kinetik ialah 0.2.

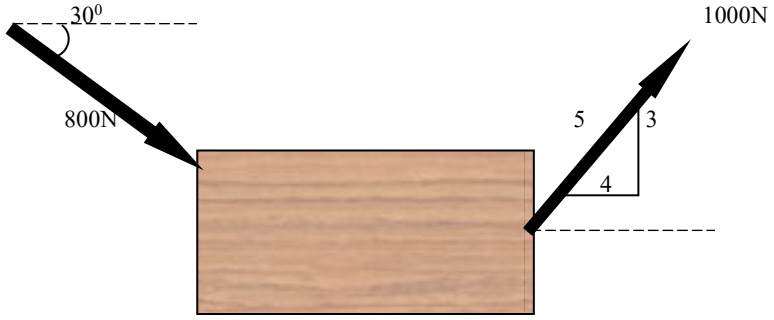


Figure 4(b) / Rajah 4(b)

[8 marks]

[*8 markah*]

CLO1 (c) 4 kg collar A can slide without friction along a vertical rod DE. Collar A is released from rest in the position shown in Figure 4(c) with the springs undeformed. Given that the stiffness of each spring is 300 N/m.

Collar A yang berjisim 4 kg bebas meluncur (tanpa geseran) sepanjang rod menegak DE. Collar A dilepaskan dari keadaan pegun seperti posisi yang ditunjukkan pada Rajah 4(c) dengan spring berada dalam keadaan panjang asalnya (tidak memanjang /memendek). Diberi kekakuan spring ialah 300 N/m.

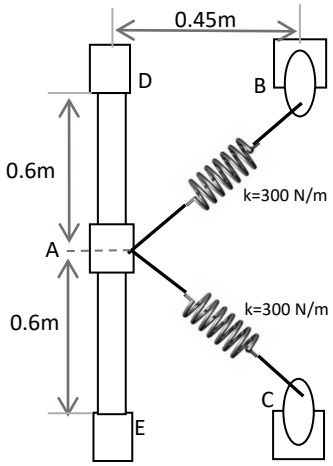


Figure 4(c) / Rajah 4(c)

(i) Calculate the length of spring AB and AC during at rest and after collar A moving downward 100 mm.

Kirakan panjang spring AB dan AC ketika dalam keadaan pegun dan selepas collar A bergerak 100 mm ke bawah

[4 marks]

[*4 markah*]

(ii) Calculate the velocity of collar A after it has moved 100 mm downward.

Kirakan kelajuan collar A setelah ianya bergerak 100 mm ke bawah

[9 marks]

[*9 markah*]

END OF QUESTIONS
SOALAN TAMAT

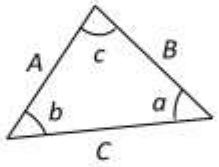
POLITEKNIK MALAYSIA

LIST OF FOMULA

DJJ30093 ENGINEERING MECHANICS

STATICS

1. TRIANGLE RULE



Sine law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Cosine law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos c}$$

2. ADDITION OF SYSTEM OF COPLANAR FORCE

$$\left(\overset{+}{\rightarrow}\right)\ \Sigma F_x = F_{1x} + F_{2x} - F_{3x}$$

$$(+\uparrow)\ \Sigma F_y = F_{1y} - F_{2y} + F_{3y}$$

$$F_R = \sqrt{(\Sigma F_x)^2 + (\Sigma F_y)^2}$$

$$\theta = \tan^{-1}\left(\frac{\Sigma F_y}{\Sigma F_x}\right)$$

3. CARTESIAN VECTOR

$$\mathbf{F} = F_x\mathbf{i} + F_y\mathbf{j} + F_z\mathbf{k}$$

$$\mathbf{u}_A = \frac{\mathbf{F}}{F} = \frac{F_x}{F}\mathbf{i} + \frac{F_y}{F}\mathbf{j} + \frac{F_z}{F}\mathbf{k}$$

$$cos^2\alpha + cos^2\beta + cos^2\gamma = 1$$

$$\mathbf{F}_R = \Sigma\mathbf{F} = \Sigma F_x\mathbf{i} + \Sigma F_y\mathbf{j} + \Sigma F_z\mathbf{k}$$

$$\mathbf{r} = (x_B - x_A)\,\mathbf{i} + (y_B - y_A)\mathbf{j} + (z_B - z_A)\mathbf{k}$$

$$\mathbf{F} = F\mathbf{u} = F\frac{\mathbf{r}}{r}$$

4. EQUILIBRIUM OF PARTICLE

$$\Sigma\mathbf{F} = 0$$

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = \frac{ds}{dt}$$

$$a = \frac{dv}{dt}$$

$$a\,ds = v\,dv$$

2. UNIFORM RECTILINEAR MOTION

- *a constant*:

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(v + u)t$$

$$v = r\omega$$

$$a = r\alpha$$

3. WORK OF FORCE

$$U_{1-2} = (F\cos\alpha)\Delta s$$

4. KINETIC ENERGY OF PARTICLE

$$KE = \frac{1}{2}mv^2$$

$$U_{1-2} = T_2 - T_1$$

5. POTENTAL ENERGY

$$PE = mgh$$

6. ANGULAR VELOCITY

$$\omega_2 = \omega_1 + \alpha t \qquad \theta = \omega_1 t + \frac{1}{2}\alpha t^2$$

$$\omega_2{}^2 = \omega_1{}^2 + 2\alpha\theta \qquad \theta = \frac{1}{2}(\omega_2 + \omega_1)t$$